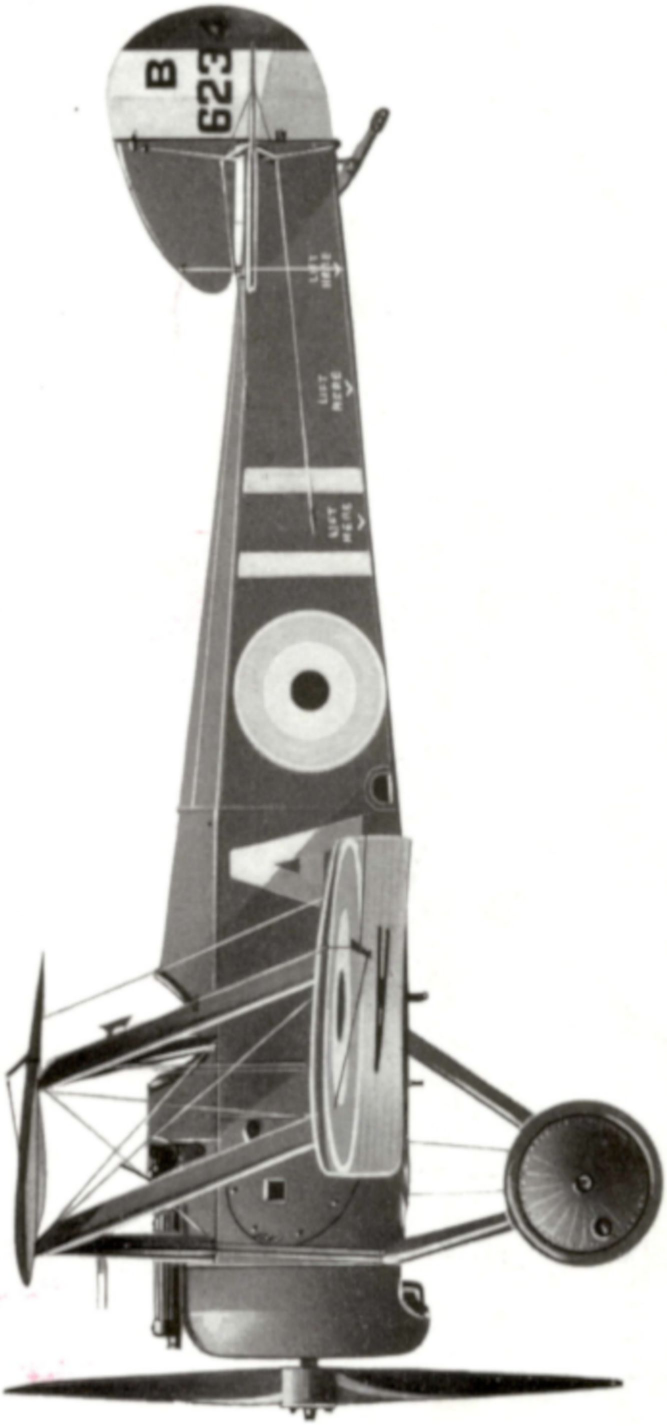
PROFILE
PUBLICATIONS

NUMBER 31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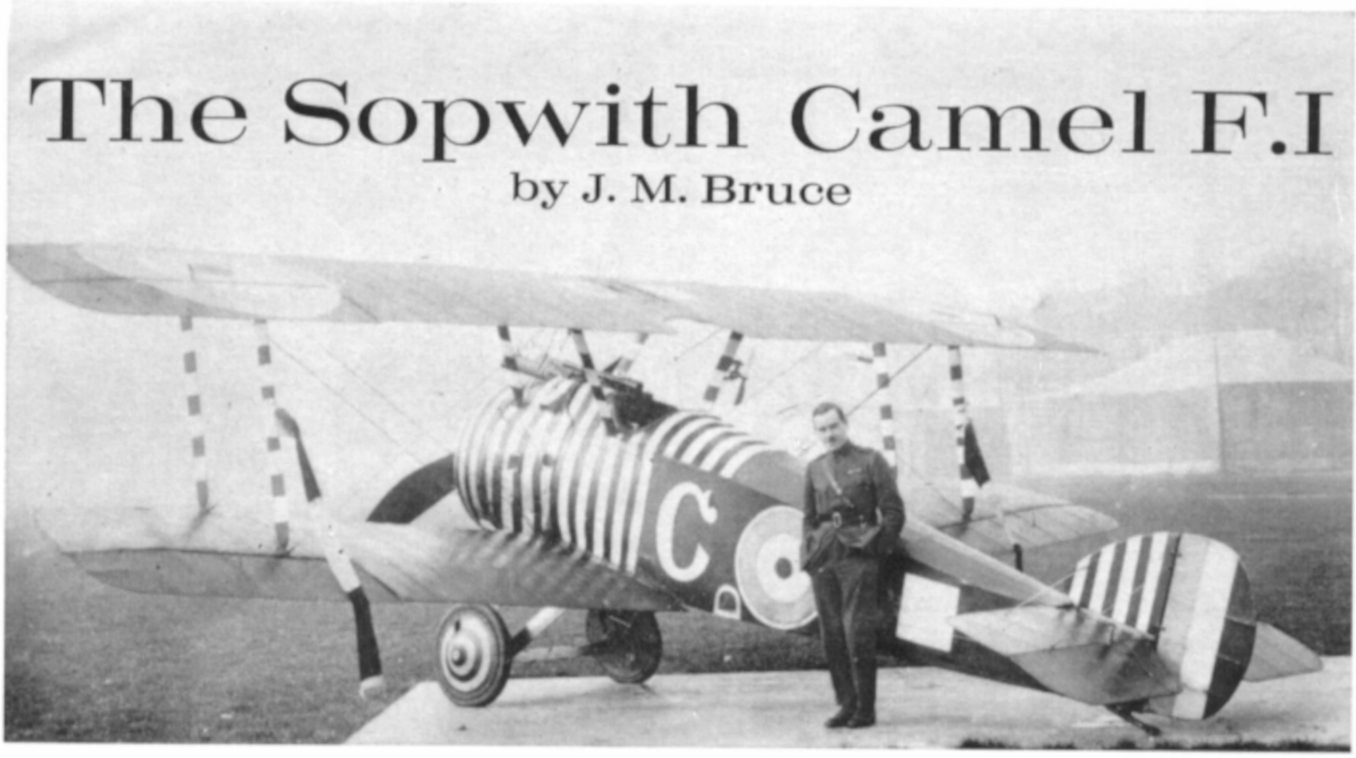
The Sopwith Camel

The Sopwith Camel F.I

by J. M. Bruce



Some of the Camels of No. 28 Squadron, operating in Italy, were given striking paint schemes. Captain Wilson stands beside "C", which bore its individual letter to the left of the cut-out, above the upper wing, with the squadron marking (a white square) to starboard. (Photo: K. M. Molson)

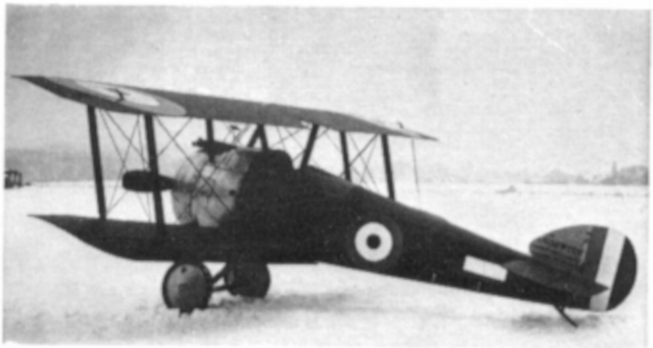
IN war's relentless school of experience the flying services quickly learned that, in aerial combat, victory most frequently went to the aircraft in which speed, climb, manœuvrability strength, armament and a good view for the pilot were combined in the best proportions. In 1916 the slow but sturdy D.H.2 and F.E.2b had proved to be effective enough to combat the Fokker monoplanes, but the introduction in mid-September 1916 of the twin-gun Albatros D I, closely followed by the D. II, placed aerial supremacy within the grasp of German fighter pilots.

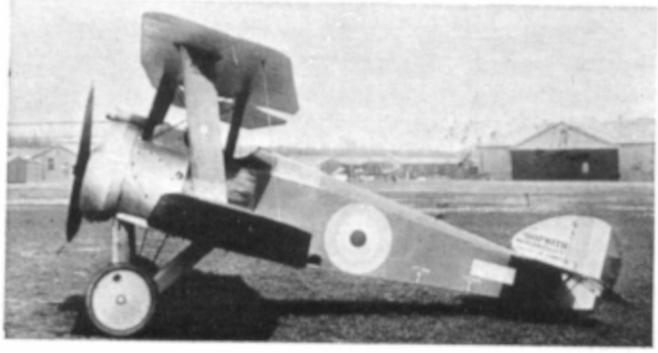
The unequalled tractability of the Sopwith Pup and triplane enabled them to hold their own for several months, but it was obvious that a faster and more heavily armed single-seater would soon be needed to match the developments of the Albatros fighters. Herbert Smith's successor to his elegant little Pup and triplane was an unprepossessing little biplane the first example of which, powered by a 110-h.p. Clerget 9Z rotary engine, was passed by the Sopwith company's experimental department on December 22, 1916.

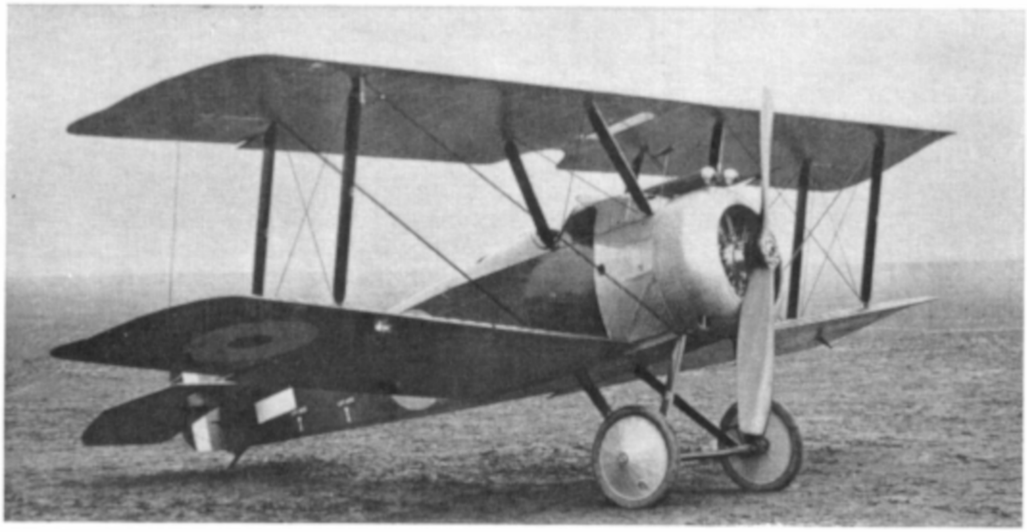
This aircraft, designated Sopwith F.1, was clearly descended from the Pup but had a deeper fuselage with a pair of Vickers guns partly faired over by a humped top decking immediately behind the engine cowling. The entire wooden airframe was conventional in structure, being typical of the period and, in particular, of Herbert Smith's design. The F.1 was originally intended to have equal dihedral on upper and lower wings, but Fred Sigrist decided that the upper wing should be flat so that it could be made in one piece and thus speed production. As a rough rule-of-thumb compensation the dihedral of the lower wing was doubled. In the event, production aircraft had the upper wing made in three parts, but no attempt to restore equal dihedral was made. Ailerons were fitted to upper and lower mainplanes.

The number and relationship of the F.1 prototypes is not at present clear, but the following facts are known. The unnumbered prototype F.1/3 was built under Licence No. 6: this suggests that the Sopwith F.1 was conceived and the building of at least four prototypes undertaken as a private venture. Two prototypes, *N517* and *N518*, were ordered (separately, it seems, from the others) by the Admiralty at a very early stage: *N517* was tested at Brooklands on

Left: *The first Sopwith F.1 at Brooklands, winter 1916–17, with one-piece upper wing and short-span ailerons. There was no central cut-out, and the humped fairing over the guns sloped upwards to the cockpit in lieu of a windscreen.* (Photo: Imperial War Museum.)
Right: *The Sopwith F.1/1 at Brooklands, spring 1917.*

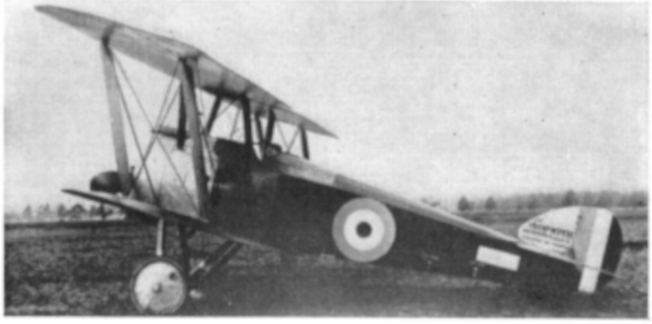






This may have been the F.1/2. It had the one-piece upper wing, original ailerons and the same disposition of the metal cowling panels as the F.1, but a central cut-out was provided in the upper wing and there was a windscreen.

Below: *The F.1/3 at Martlesham Heath, March 1917. The design of the metal panels behind the engine cowling was changed slightly, but in all other respects the aircraft resembled the supposed F.1/2.*



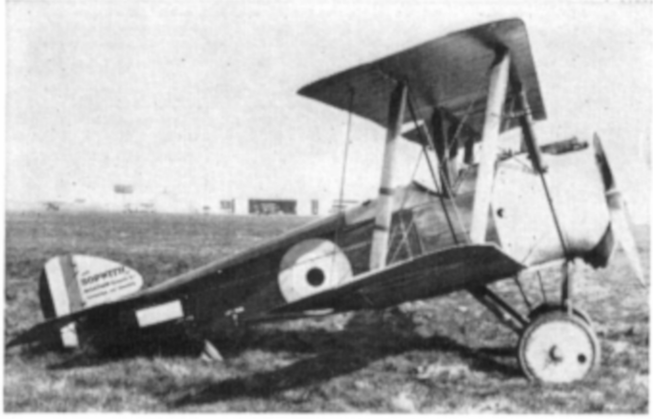
February 26, 1917. Two official reports describe the taperwing prototype as the F.1/1 (apparently it did not acquire an official serial number), suggesting that it had followed the 110-h.p. F.1 in the Sopwith shops. A recorded reference to an F.1/2 has yet to be found, but an aircraft that might have qualified for that designation existed. It displayed several minor differences from the first F.1. The one-piece upper wing was retained but had a central cut-out between the spars to improve the pilot's upward view; the shape of the top decking immediately behind the guns was modified and a small windscreen was fitted.

A further prototype, known to be F.1/3, was tested at Martlesham Heath in March 1917, powered originally by a 130-h.p. Clerget 9B No. 2730. The official report states:

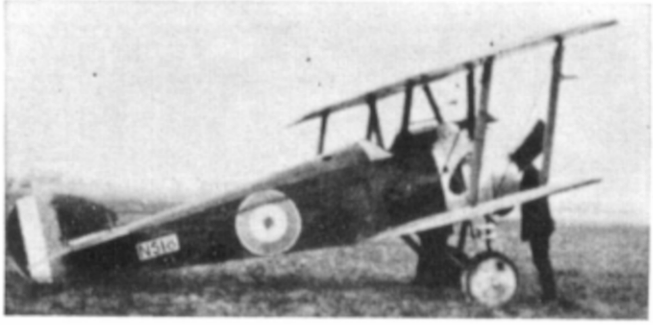
> "Of the series of F.1 experimental machines the above No. F.1/3 was the type upon which the standard F.1 is based. The dimensions and tank capacities of the latter vary slightly from the above."

It seems that the F.1/3 prototype, like the F.1/1, did not receive an official serial number. In May 1917 it was tested with a 110-h.p. Le Rhône 9J engine (No. 100508/W.D.7917); in July it was being flown at Martlesham with a 130-h.p. long-stroke Clerget. The latter engine was properly the 140-h.p. Clerget 9Bf, which had a stroke of 172 mm.; the stroke of the 130-h.p. Clerget 9B was 160 mm. The diameter of both was 1,020 mm.; the compression ratio of the 9B was 4·56 to 1, that of the 9Bf either 5·29 or 5·14 to 1.

The second Admiralty prototype, *N518*, was tested in May 1917 with the first example of the 150-h.p. A.R.1 (Admiralty Rotary). This was a nine-cylinder rotary of the same bore (120 mm.) as the Clerget 9B and 9Bf; its stroke was 170 mm. Although in appearance somewhat similar to the Clerget, the A.R.1 was a little larger (diameter 1,064 mm.) and differed considerably: it has a place in aero-engine history as the first production engine to embody aluminium as an air-cooled cylinder material. This engine was designed by Lt. W. O. Bentley and was later renamed B.R.1 (Bentley Rotary).

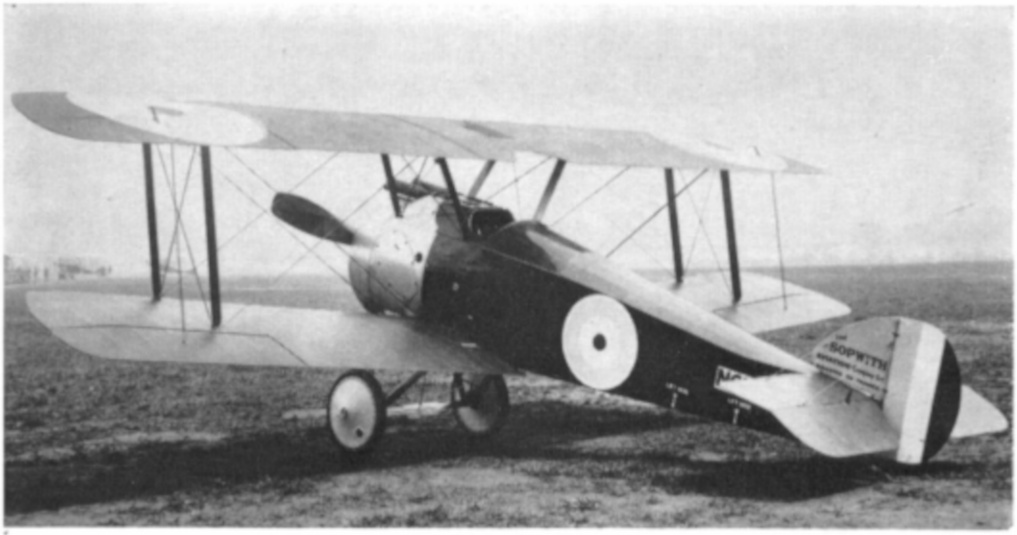


The precise identity of this aircraft is uncertain. It might have been the F.1/3 modified to production standard with three-piece upper wing and lengthened ailerons; alternatively it might have been a later prototype or an early production aircraft.
(Photo: Imperial War Museum)



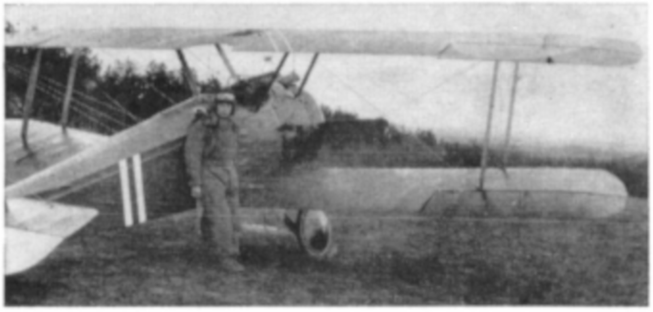
The second Admiralty prototype, N518, *at the Isle of Grain.*

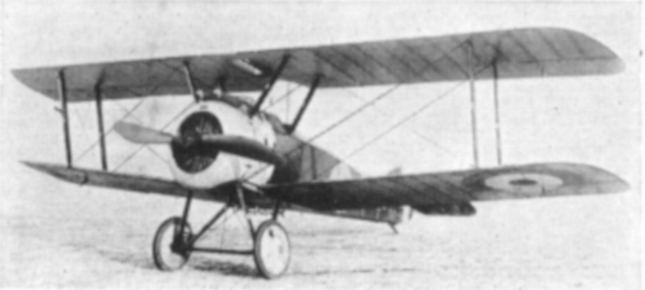
The F.1/1 version of the design was also subjected to official tests at Martlesham in May 1917 but its performance with the 130-h.p. Clerget was no better than that of the constant-chord type. Its landing speed was higher and it would have been more complicated to manufacture because wing ribs of varying sizes had to be made; it is therefore not surprising that it was abandoned. The chord of the centre section was 5 ft. on the F.1/1; at the outboard end of the straight portion of the leading edge it was 3 ft. 6 in. (chord of the standard F.1 was 4 ft. 6 in.). The spars of the tapered panels were 2 ft. 6 in. apart at the roots but



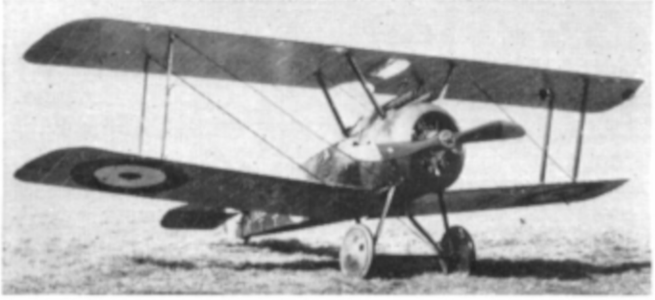
The third production Camel, N6332, *which was transferred to the Royal Flying Corps.*

Below: *A famous Bentley Camel of No. 209 Squadron, R.A.F. Captain Roy Brown stands beside* B7270, *the Camel he was flying during the combat in which Rittmeister Manfred, Freiherr von Richthofen, was killed on April 21, 1918. In common with many of No. 209's Camels, the fuselage roundel on* B7270 *was obliterated, and it is possible that the serial numbers were also painted over.*
(Photo: R.C.A.F., via K. M. Molson)





Clerget Camel B6290, *with rack for four Cooper bombs under the fuselage.* (Photo: Peter M. Bowers)



B3811 *with 100-h.p. Gnôme Monosoupape engine.* (Photo: "Aeromodeller")

converged sufficiently to enable single plank-type interplane struts to be fitted; these were attached by sheet-steel fittings similar to those used on the Sopwith triplane.

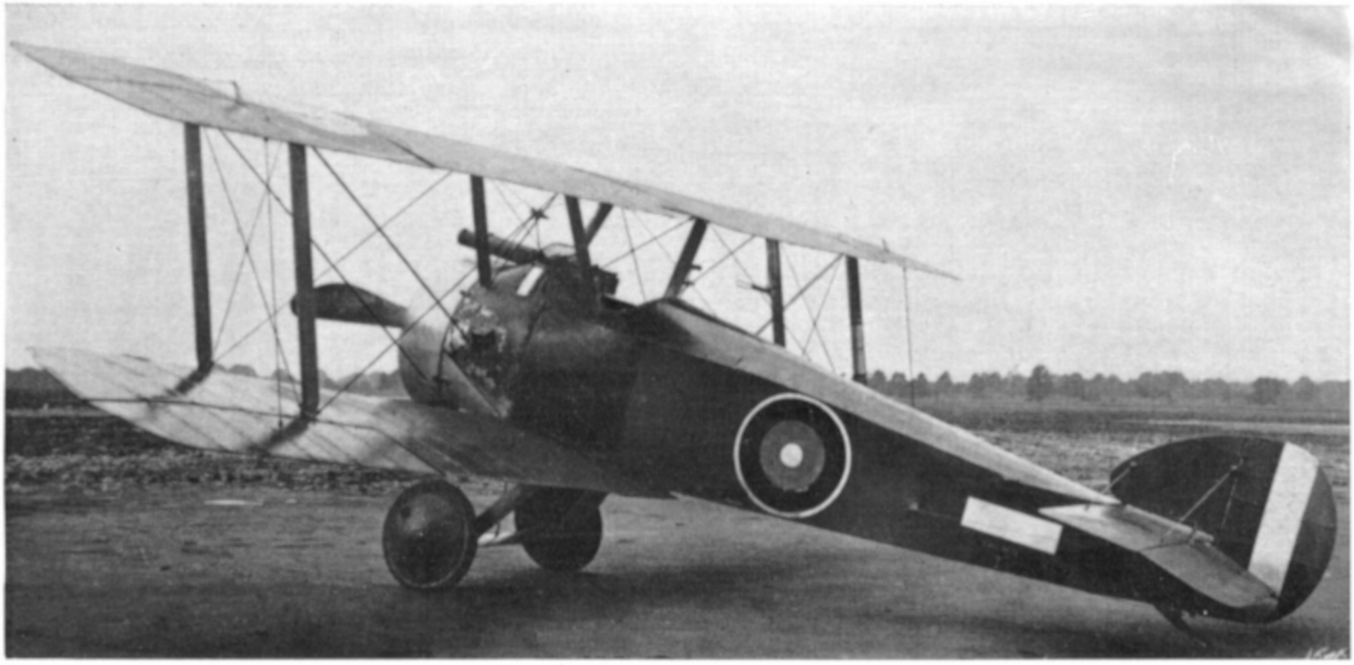
On the production aircraft the top wing was made in three parts, presumably to facilitate assembly and maintenance; the ailerons were longer than those of the early prototypes. The 130-h.p. Clerget 9B and 150-h.p. B.R.1 were the standard engines, and the aluminium panels behind the engine were of the modified shape that first appeared on the F.1/3.

The flying services were quite as quick to find a name for the F.1 as they had been in the case of the Pup. The humped fairing over the gun breeches was somewhat accentuated by the downward slope of the upper longerons behind the cockpit and by the sharp dihedral of the lower wing. Given the characteristic sense of humour of the flying men of the time, the choice of the name Camel was inevitable, and it swiftly gained universal currency. It was never an official designation.

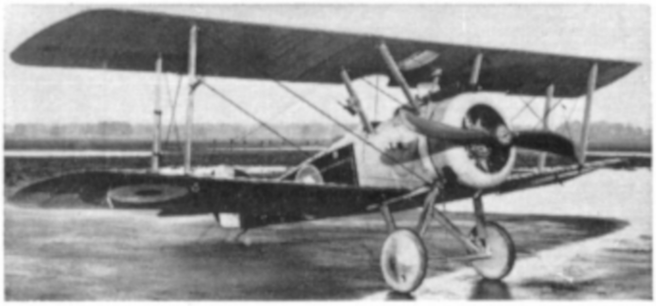
By the time *N518* had reached Martlesham for its official trials production of the B.R.1 was under way, and this engine was installed in some of the first production Camels of the Sopwith-built batch *N6330–N6379*, deliveries from which began on May 7, 1917. Bentley Camels of No. 4 Naval Squadron were in action on July 4, 1917, when five attacked sixteen Gothas about thirty miles north-west of Ostend. Flight Commander A. M. Shook claimed to have shot down one Gotha in flames and Flight Sub-Lieut. S. E. Ellis claimed to have driven down another apparently out of control.

By the end of July 1917 the Camel equipped Naval Squadrons Nos. 3, 4 and 6; No. 9 Naval Squadron received its first Camel on July 13 and was fully re-equipped with the type by August 4. The triplanes of Naval Eight were replaced by the stubby little biplane between July and September, and No. 10 Naval Squadron likewise relinquished its beloved triplanes in August.

The first production contract (A.S. 1809) for the War Office was given to Ruston Proctor & Co. on May 22, 1917 and was initially for 250 Camels numbered *B2301–B2550*; the 130-h.p. Clerget was specified. Later, *B5551–B5650*, *B7281–B7480*, *C8201–C8300* and *D1776–D1975* were all delivered under that same contract. From Portholme Aerodrome *B4601–B4650* were ordered under Contract No. 87/A/1836 on June 2, 1917 (*B7131–B7180* were later ordered under the same contract); and a week later the Sopwith company undertook to supply *B3751–B3950* under Contract No. A.S. 6175, an order that was subsequently augmented by *B6201–B6450*.



Camel in U.S. Air Service markings, fitted with 150-h.p. Gnôme Monosoupape engine, at Martlesham Heath, October 1917.



F6394 *with 170-h.p. Le Rhône 9R engine, at Martlesham Heath, February 1919. An enlarged rudder was fitted.*
(Photo: Imperial War Museum)

For the aircraft ordered from the Portholme Aerodrome, Hooper & Co., and March, Jones & Cribb, the 110-h.p. Le Rhône 9J was specified; it was also quoted as an alternative to the Clerget 9B in the Sopwith contract. In reality not all of the Camels for which the Le Rhône was specified had that engine exclusively: either in production or in service the Clerget was substituted. Many Camels of the Sopwith batches *B3751–B3950* and *B6201–B6400* went to Naval squadrons and were fitted with B.R.1 engines.

An engine change apparently entailed a change of gun-synchronising gear. The standard mechanism of the Clerget-powered Camel was the Sopwith-Kauper No. 3, a mechanical interrupter gear; the Le Rhône version had the superior Constantinesco hydraulic gear.

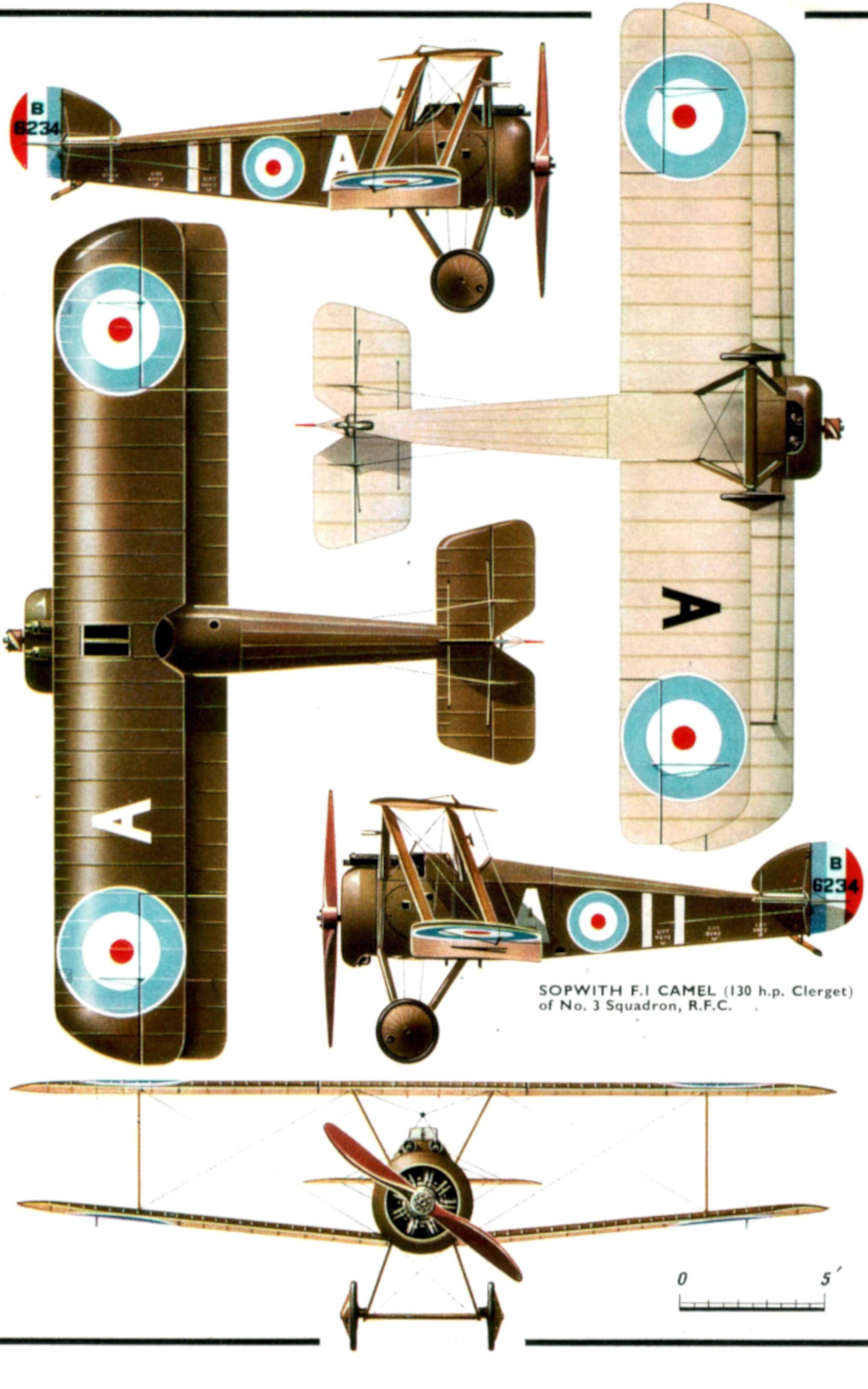
As noted above, the first installation of a Le Rhône was made in the F.1/3 prototype. The airscrew used on the Martlesham tests in May 1917 was the same Lang type (L.P.2850) that had been used on F.1/3 when it was tested with the Clerget. With the Le Rhône engine the aircraft was a little slower in level flight, but its climbing performance was better.

Pilots who had been accustomed to the docile tractability of the Pup and triplane or to the stable 1½-Strutter found the Camel dangerously different. "Here was a buzzing hornet," wrote Wing Commander Norman Macmillan in *Into the Blue*, "a wild thing, burning the air like raw spirit fires the throat." The Camel's response to the controls was remarkably swift; its elevators were especially powerful. The strong torque reaction of the rotary engine had a pronounced effect on the aircraft's handling characteristics. The Camel could turn very tightly because the main masses of engine, fuel, armament and pilot were grouped close together, but the engine torque caused the nose to rise in a left-hand turn and drop in a right-hand turn. Fairly coarse rudder was required to correct these tendencies, and so sensitive was the Camel that the turn needed to be tightened very little before the aircraft would spin, quickly and without warning.

Those who mastered the Camel's idiosyncrasies found in it an ideal fighting aeroplane. Although it was not the stable gun platform that the S.E.5a was, its extraordinary manœuvrability enabled it to hold its own as a combat aircraft until the end of the war. Its best fighting altitude was about 12,000 ft. At that height a skilled Camel pilot could dictate fighting terms to any enemy fighter. The Camel was flown by such distinguished pilots as Lt.-Col. R. Collishaw, D.S.O., D.S.C., D.F.C. (60 victories), Major D. R. MacLaren, D.S.O., M.C., D.F.C. (54 victories), Major W. G. Barker, V.C., D.S.O., M.C.(53 victories), and Captain H. W. Woollett, D.S.O., M.C., whose total victory score of 35 included six shot down in one day, April 12, 1918.

The first R.F.C. unit to be fully equipped with F.1 Camels was No. 70 Squadron, which had replaced its 1½-Strutters by the end of July 1917. In that same month No. 45 Squadron began to re-equip with Camels, and many other fighter squadrons flew the little Sopwith in the months that were to follow.

Production gathered momentum as 1917 advanced. By the end of March 135 Camels had been delivered; 471 passed inspection in the next three months, followed by a further 719 in the last quarter of the year. The year's total of 1,325 must have consisted almost entirely of F.1 Camels, as deliveries in quantity of the 2F.1 ship-board variant did not start until early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SOPWITH F.1 CAMEL (130 h.p. Clerget)
of No. 3 Squadron, R.F.C.

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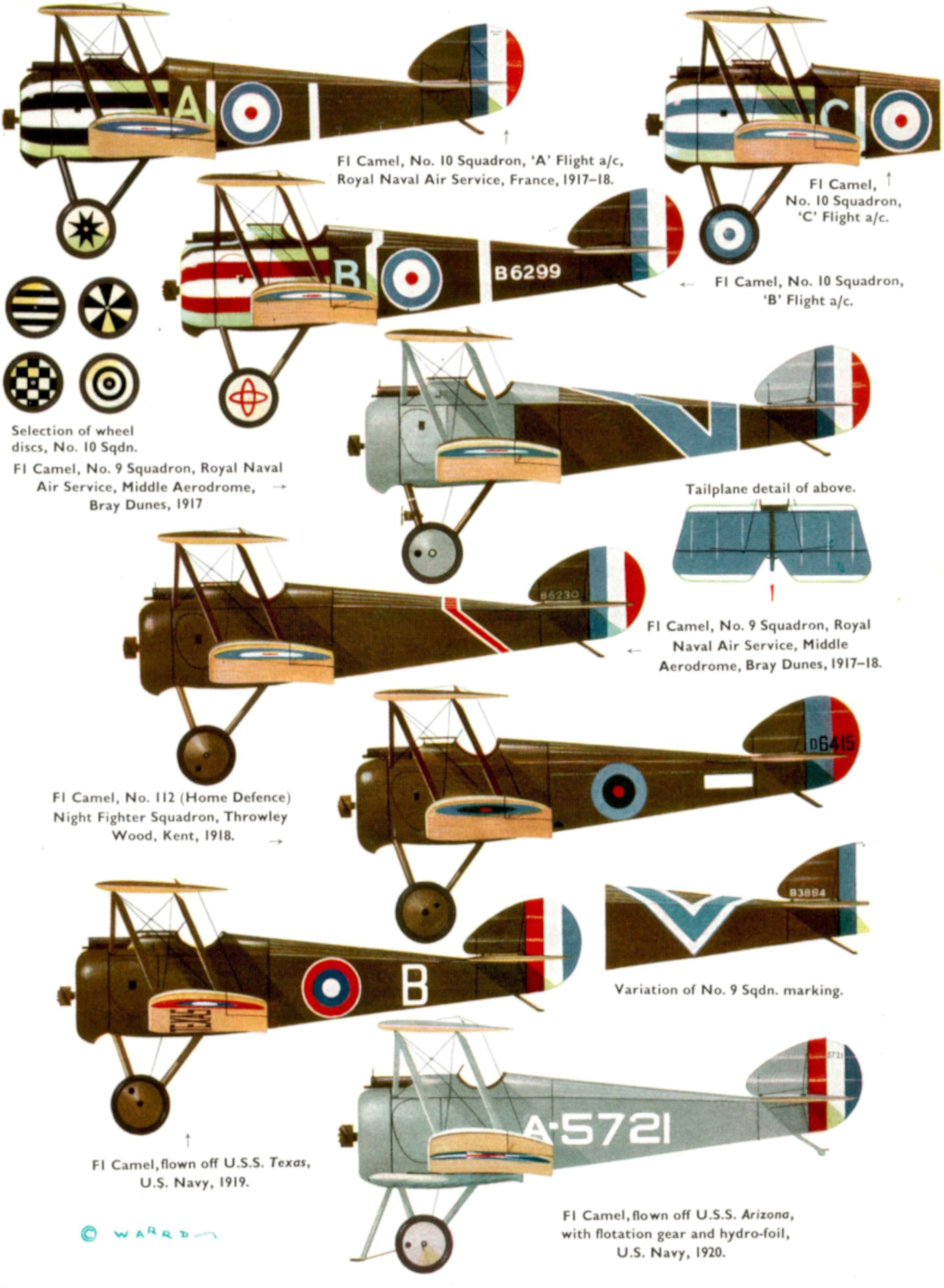


F1 Camel, No. 10 Squadron, 'A' Flight a/c, Royal Naval Air Service, France, 1917–18.

F1 Camel, No. 10 Squadron, 'C' Flight a/c.

F1 Camel, No. 10 Squadron, 'B' Flight a/c.

Selection of wheel discs, No. 10 Sqdn.

F1 Camel, No. 9 Squadron, Royal Naval Air Service, Middle Aerodrome, Bray Dunes, 1917 →

Tailplane detail of above.

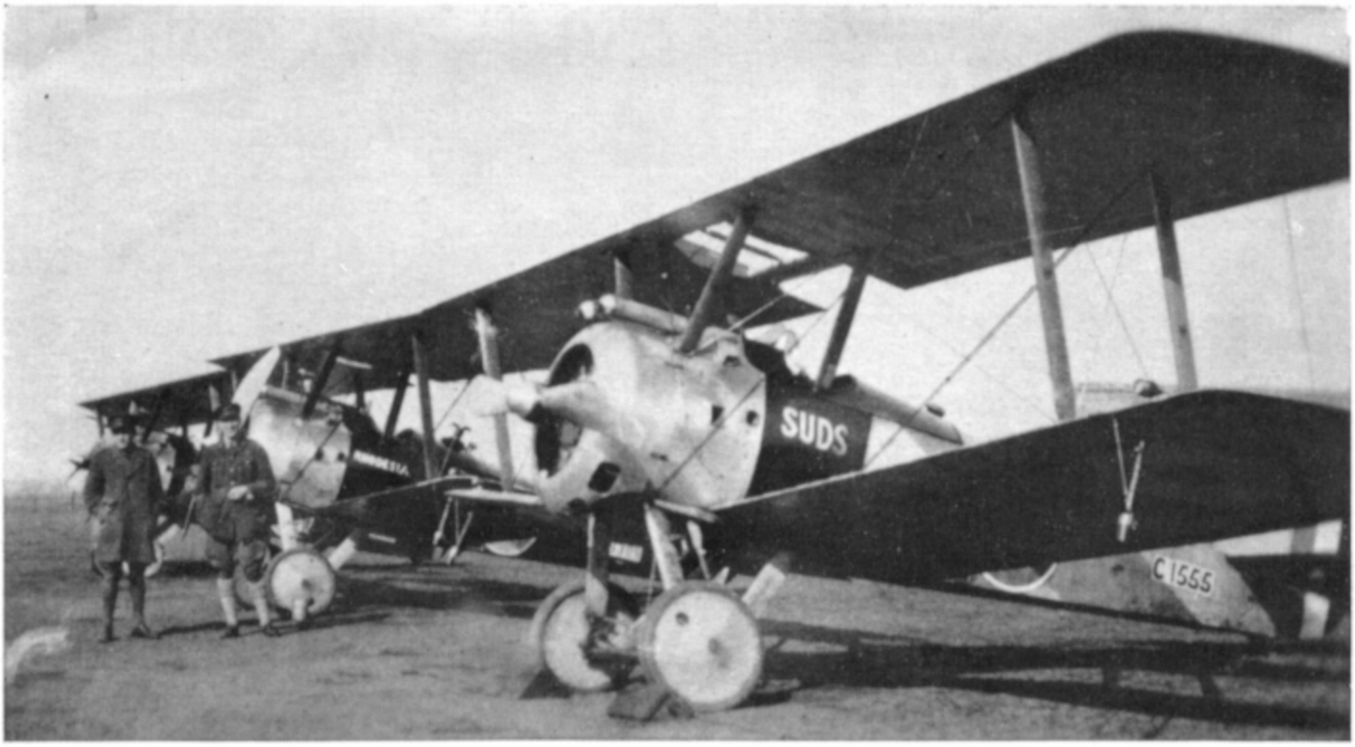
F1 Camel, No. 9 Squadron, Royal Naval Air Service, Middle Aerodrome, Bray Dunes, 1917–18.

F1 Camel, No. 112 (Home Defence) Night Fighter Squadron, Throwley Wood, Kent, 1918. →

Variation of No. 9 Sqdn. marking.

F1 Camel, flown off U.S.S. *Texas*, U.S. Navy, 1919.

F1 Camel, flown off U.S.S. *Arizona*, with flotation gear and hydro-foil, U.S. Navy, 1920.

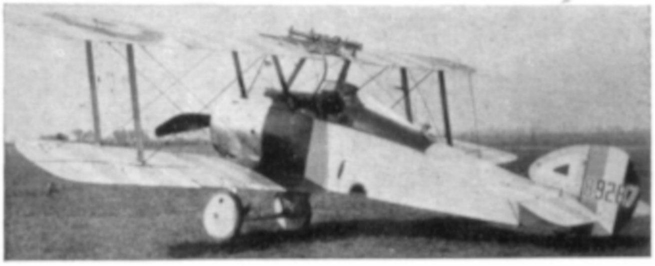


Standard Le Rhône Camels equipped for night flying with flare brackets and navigation lights. These aircraft are said to have belonged to No. 44 (Home Defence) Squadron, but it is equally possible that they may have belonged to No. 78. (Photo: K. M. Molson)

1918. In 1917 a total of 1,546 Clerget and 540 Le Rhône engines passed inspection for the British flying services, and 879 Clergets and 1,314 Le Rhônes of French manufacture were delivered. Output of the 150-h.p. B.R.1 totalled 269 by the end of 1917.

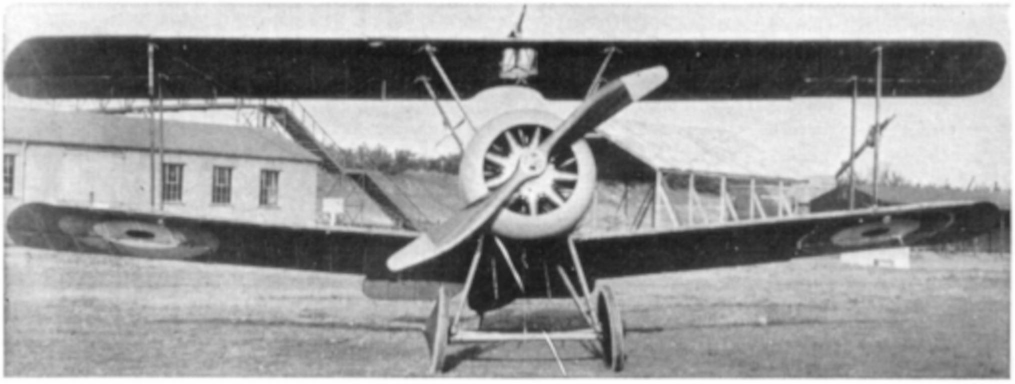
On December 29, 1917 Contract No. A.S. 34277 (for *D8101–D8250*) was given to Ruston Proctor & Co., and A.S. 37028 (for *D9381–D9580*) to Boulton & Paul Ltd.; these brought the total of F.1 Camels ordered during 1917 to 3,450. Hundreds more were going to be needed and it must have seemed unlikely that engine deliveries could possibly match the output of airframes, for the rotaries that powered the Camel were in considerable demand for several other types of aircraft.

It may have been in anticipation of this situation that *B3811* was tested in August 1917 with a 100-h.p. Gnôme Monosoupape engine (No. 30748/W.D.1182). The Aircraft was flown with an 8 ft. 7 in. airscrew of the type usually fitted to the D.H.5 (Aircraft Manufacturing Co. drawing No. T.1708), and its performance did not compare unfavourably with that of the Clerget and Le Rhône Camels. It is almost certain that operational use of the Monosoupape Camel was envisaged, for it was fully armed and was tested with an oxygen cylinder in various positions. Confirmation that any 100-h.p. Monosoupape Camel went to an operational unit has yet to be found. The variant has been linked with training units because its engine was regarded as being easier to control than the Clerget or Le Rhône. It is likely that some did in fact see service with training squadrons, but references to this version of the Camel are scanty; indeed it seems unlikely that many aircraft had the engine.



Night-fighter version of the F.1 Camel, almost certainly of No. 78 Squadron, in post-Armistice colour scheme.
(Photo: National Aviation Museum of Canada)

In July 1917, as noted above, F.1/3 was tested at



The Sopwith TF.1, with two downward-firing Lewis guns between the undercarriage legs and a third Lewis gun above the centre section. The underside of the fuselage was armoured back to the rear of the cockpit.

Martlesham with a Clerget 9Bf engine at both compression ratios. The higher ratio (5·29 to 1) gave the better performance. As Clergets of this type became available they were fitted to production Camels.

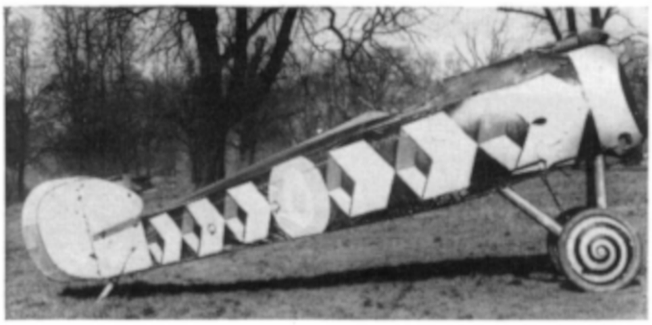
During that same month the B.R.1 engine of *B3835* was subjected to a series of modifications. W. O. Bentley, designer of the engine, had discovered that it could be persuaded to give 11 h.p. more if a 2-mm. hole was bored in the top casting of each induction pipe. *B3835* was tested with its engine in five different conditions, viz.:

(1) compression ratio 5·2 to 1, standard induction pipes with 2-mm. holes;
(2) compression ratio 5·5 to 1, standard induction pipes with 2-mm. holes;
(3) compression ratio 5·2 to 1, large induction pipes without holes;
(4) compression ratio 5·5 to 1, large induction pipes with 2-mm. holes;
(5) compression ratio 5·7 to 1, large induction pipes with 2-mm. holes.

The best results were obtained with the engine in the fifth condition.

On all fronts the Camel was used until the Armistice. On October 31, 1918 the Royal Air Force had on charge 385 B.R.1 Camels, 1.342 Clerget Camels, and 821 with the Le Rhône or Monosoupape engine. With the exception of the Home Defence version. described below, these Camels were not materially different from those that had gone into service eighteen months earlier, and the redoubtable little Sopwith had earned a warlike reputation wherever it had fought. In service, pilots made their own minor modifications: some liked to have the windscreen forward of the gun breeches to facilitate jam clearing; the cut-out in the centre section was frequently enlarged. For ground-attack work (of which the Camel did a great deal in the Battles of Ypres and Cambrai) a rack for four 20-lb. Cooper bombs was fitted under the fuselage just behind the rear undercarriage legs.

In December 1917 Martlesham tested a Camel with a 150-h.p. Gnôme Monosoupape engine. This rotary power unit was of the same diameter (980 mm.) as the earlier 100-h.p. Monosoupape, but its bore and stroke were respectively 115 mm. and 170 mm.; those of the 100-h.p. engine were 110 mm. and 150 mm. The 150-h.p. engine had a compression ratio of 5·2 to 1 (4·85 to 1 on the 100-h.p. type); and dual ignition, with two plugs per cylinder, was fitted. The most unusual feature of the 150-h.p. Monosoupape was a multi-position ignition switch that enabled the engine to run on 9, 7, 5, 3 or 1 cylinders. "It was an amusing experience," wrote the late S. D. Heron,* "to watch a fighter aircraft flying close to the ground on one cylinder and then suddenly cut in all nine with a terrific blast of flame from the engine cowl."



That first test of a Camel with the 150-h.p. Monosoupape produced performance figures that compared well with those of the B.R.1 Camel, but the engine was not adopted for British use. British Camels known to have been fitted with it were *B2451* and *B6329*.

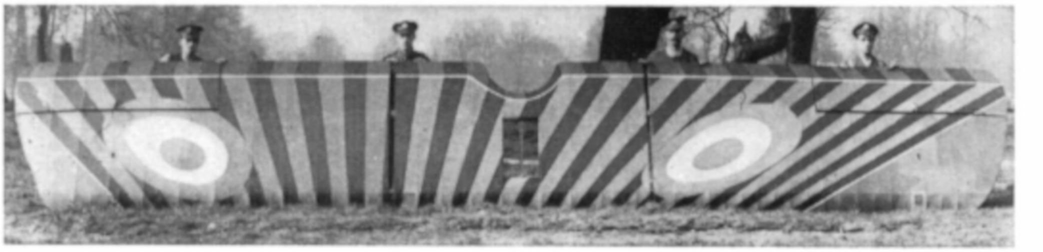
The Camel was flown by four squadrons of the United States Air Service in 1918; in June of that year 143 Clerget Camels were bought from the British Government for the equipment of these units. The U.S.A. had also bought a number of 150-h.p. Gnôme Monosoupape engines, and the Air Service wanted these installed in Camels. The job of fitting the engines to Camels on a production basis was entrusted to Boulton & Paul Ltd., major contractors for the type. Of this combination Captain Frank Courtney wrote:†

> "The history of the Mono Camel was brief but highly eventful. B. & P. built wonderful Camels, but they could not control the mixed marriage with the Monos, and this was one more problem which was removed by the ending of the war."

An unnumbered Camel with the 150-h.p. Monosoupape, in American markings, was tested at Martlesham in October 1918. This aircraft was 82 lb. heavier than the Camel that had been tested in December 1917, and its performance was somewhat poorer.

The last experimental engine installation to be made in a Camel was of a 170-h.p. Le Rhône 9R. Its bore (115 mm.) was 3 mm. greater than that of the earlier 110-h.p. Le Rhône 9J; the compression ratios of the 170-h.p. and 110-h.p. engines were respectively 5·6 to 1 and 4·83 to 1. There is little doubt that an earlier installation of the 170-h.p. Le Rhône was made in France in *B3891*, which had been transferred to the French government (and may also have had a 150-h.p. Gnôme Monosoupape at one time).

Subject of the later British installation was *F6394*, on which the engine mounting and cowling had to be modified to accommodate the engine. The Le Rhône was reported to throttle down well and to have good slow-running qualities. Martlesham did not test this



Above : *Experiments in dazzle-painting, using a night-fighter Camel as subject. The object was apparently to lead enemy pilots to fire at a false aiming point.*

(Photos:
Imperial War Museum)

Left : *Depicts the upper surface of the top wing.*

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*History of the Aircraft Piston Engine (*Ethy Corporation, Detroit, 1961*), *page 8.*

†Flight, *8th July, 1955, page 50*

Camel until February 1919, but it might not have seen service even if the war had continued: its performance was no better than that of the B.R.1 Camel, and the engine had several small air scoops on the crankcase of which the official report said:

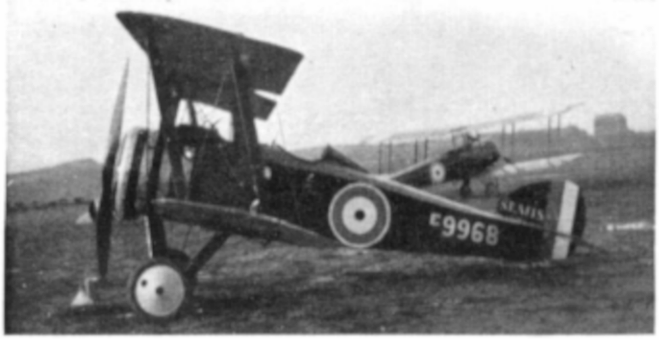
> "These might prove disadvantageous on a dusty aerodrome when the machine was left standing with the wooden plugs in or when running up on the ground."

This aircraft had an enlarged rudder of the type fitted to a few Camels late in 1918.

The Camel was introduced to Home Defence duties in August 1917, and on September 3 Captain C. J. Q. Brand and Lt. C. C. Banks of No. 44 Squadron, R.F.C., proved that, tricky though it was, it would be flown at night. Early night combats showed that pilots were momentarily blinded by the flash of their guns, and it was considered that there was danger in firing explosive and incendiary ammunition through the airscrew.

To overcome these difficulties a special version of the Camel was evolved for night fighting; this was done primarily by modifying existing airframes. Twin Lewis guns on a double Foster mounting were carried above the centre section, and the cockpit was moved aft of the upper wing to enable the pilot to operate the guns effectively. In the standard Camel the main fuel tank was behind the pilot's seat, but in the night fighter a standard B.E.2e petrol tank was installed between the centre-section struts within the fuselage. One of the upper horizontal spacers of the fuselage had to be removed because the cockpit was moved aft, and the upper longerons had to be reinforced. The strengthening pieces were glued and bound to the inboard sides of the longerons, making the cockpit somewhat more cramped than that of the standard Camel. The flying controls were modified, a B.E.2e rudder bar replacing the standard Sopwith component; navigation lights and flare brackets were fitted. The 110-h.p. Le Rhône was the standard engine of this variant, which apparently shared with the single-seat Home Defence version of the 1½-Strutter the nickname "Sopwith Comic".

In service the armament of the modified Camel varied. Some pilots kept one of the Lewis guns at a 45-degree upward angle; others preferred to retain one Vickers gun, despite its disadvantages. One or two of the night-fighter Camels acquired colourful paint schemes, doubtless after the Armistice: in wartime service dark green dope was used and the national markings were either obliterated altogether or had the white painted out. The fuselage and wings of one of the night fighters were used in experiments in dazzle painting.

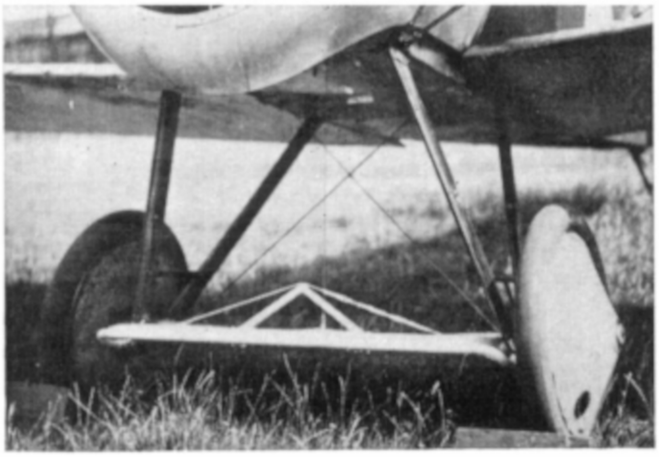

E9968 *was a Camel two-seater of the South-East Area Flying Instructors' School, hence the word* SEAFIS *on the fin.*
(Photo: C. A. Nepean Bishop)

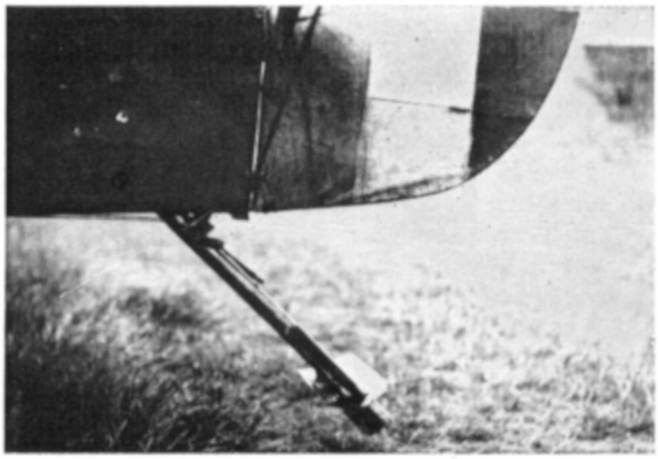
Losses of Camels on ground-attack duties were high. In February 1918 an armoured trench-strafing development, armed with two downward-firing Lewis guns and a third on the centre section, appeared with the new Sopwith type number TF.1. Its engine was a 110-h.p. Le Rhône, and the T.F.1 was a straightforward modification of the F.1 Camel *B9278*. The TF.1 did not go into production, but it provided information that helped in the design of the more advanced TF.2, the Salamander.

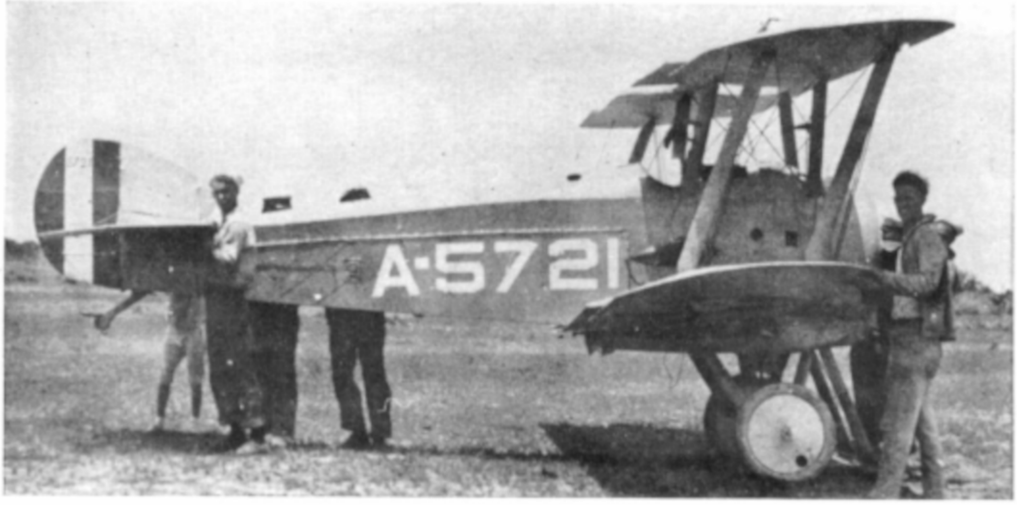
Inevitably, many accidents involving Camels occurred at training aerodromes. Many were caused by pupils' inability to alter quickly enough the fine-adjustment fuel control of the engine after take-off; their reactions to sudden loss of power were not swift enough to forestall the Camel's ruthless spin. A two-seat version of the Camel was therefore made, with the second cockpit in the same position as that of the night fighter. Flying controls, instruments, air-speed indicator pressure heads, and landing wires were all duplicated. The fuel system was revised, a smaller main tank being fitted, and the armament was removed.

Several F.1 Camels participated in experiments in launching fighter aircraft from lighters towed at high speed by destroyers. The significant achievements in this activity belong to the 2F.1 version of the Camel, but at least one F.1 that was used in the tests had a jettisonable steel-tube undercarriage and was armed in

Left: *The 9-inch (chord) hydrovane fitted in front of the undercarriage of* B3878, *August 1918.* Right: *The tail-skid of* B3878 *was fitted with a small hydrovane. This was intended to prevent the aircraft from nosing over after alighting.*







F.1 Camel of the U.S. Navy with hydrovane in front of landing wheels and Grain flotation gear under lower longerons.
(Photo: Fred C. Dickey, Jr.)

the 2F.1 manner with one Vickers gun and a Lewis gun on an Admiralty Top Plane Mounting.

These and other oversea duties led to an interest in the ditching of Camels: in early 1918 the end of a mission at sea usually left a pilot no choice but to come down on the water. Experiments began in July 1918 with a Camel numbered *6341* (prefix *B*, *F* or *N* not determined); in the following month *B3878* was tested with a hydrovane on its undercarriage; and later in August a third Camel, possibly *B6229*, was tested with a narrower hydrovane and small (450× 60 mm.) wheels. Finally jettisonable wheels were fitted. All these Camels had flotation gear consisting of airbags in the fuselage.

In addition to its use by the U.S. Air Service the Camel was used by four escadrilles of l'Aviation Militaire Belge. As many as 36 Camels may have been sent to Belgium, but this total is unconfirmed. Known serial numbers include *B5710*, *B5711*, *B5745*, *B5747* (Belgian number Sc-11), *B5748* and *B7235–B7237*. A few Camels remained in Belgian use until 1922, and *B5747* is preserved in Brussels. During the war some pilots of the Royal Hellenic Naval Air Service flew Camels.

Some Camels had gone to Russia in 1918, and the type remained in operational use there until 1920 with R.A.F. Squadrons Nos. 47 and 221. Camels were also flown by the Slavo-British Aviation Group. Some of the twenty Camels given to Poland in 1920 also went into action again in August of that year, flown by the *Eskadra Kosciuszkowska* at Lwòw against the Russians.

After the war the U.S. Navy had at least six Camels, two of which were allocated to the U.S.S. *Texas*, another to U.S.S. *Arkansas*. These were flown from shipboard platforms and were fitted with jettisonable wheels and Grain flotation gear. A small number also went to Canada; these included *F1337*, *F6310*, *F6473* and *F6481*, of which the first survived at least until July 1928.

Camels were used for various experimental purposes at the R.A.E. Farnborough. In spinning experiments a Camel had an enlarged rudder and elevators: *B2312* and *H7363* were fitted with Imber self-sealing tanks in February 1920; and *D1965* and *F6456* were extensively used in inverted-flight tests and experiments. The two last-named Camels were almost certainly the last in British official service. Had the war gone on longer than it did, the Camel would have been replaced everywhere by the Snipe, and in peacetime the Snipe remained the R.A.F.'s standard single-seat fighter for some years.

Production

Known serial numbers for production F.1 Camels total 5,695 aircraft, but at least 100 of these were cancelled, others may not have been delivered. The known batches are as follows.

Sopwith Aviation Co. Ltd., Canbury Park Road, Kingston-on-Thames—N517–N518, N6330–N6379, B3751–B3950, B6201–B6450.

Boulton & Paul Ltd., Rose Lane Works, Norwich—B5151–B5250, B9131–B9330, C1601–C1700, C3281–C3380, D6401–D6700. D9381–D9530, F1301–F1550, F1883–F1957, F6301–F6500, F8646–F8695, H2646–H2745.

British Caudron Co. Ltd., Broadway, Cricklewood, London, N.W.2—C6701–C6800, H3996–H4045 (cancelled).

Clayton & Shuttleworth Ltd., Lincoln—B5651–B5750, B7181–B7280, D3326–D3425, D9581–D9680, E4374–E4423, F3096–F3145, F4974–F5073.

Hooper & Co. Ltd., St. James's Street, London, S.W.1—B5401–B5450, C1551–C1600, F2083–F2182, H734–H833, H7343–H7412.

March, Jones & Cribb Ltd., Leeds— C8301–C8400, F5174–F5248.

Nieuport & General Aircraft Co. Ltd., Langton Road, Cricklewood, London, N.W.2—Cl–C200, F3196–F3245, F3918–F3967.

Portholme Aerodrome Ltd., St. John's Street, Huntingdon—B4601–B4650, B7131–B7180, D9531–D9580, E5129–E5178, F1958–F2007.

Ruston, Proctor & Co. Ltd., Lincoln—B2301–B2550, B5551–B5650, B7281–B7480, C8201–C8300, D1776–D1975, D8101–D8250, E1401–E1600, E7137–E7336, F2008–F2082, F3968–F4067.

The serial numbers *F8496–F8595* were also allotted for Camels, but the manufacturer is unknown.

Known A.R.D. rebuilds—B778, B7745, B7756, B7860, B7869, B7896, B8025, B8155, E9968, E9973, E9975, F2209, F4178, F4187, F4193, F4194, F4199–F4201, F4204, F5914, F5918, F5938, F5939, F5941, F5943, F5946, F5951, F5958, F5967, F5968, F5972, F5981, F5990 F5991, F5993, F6022, F6024, F6030, F6032, F6034, F6037, F6063, F6084, F6089, F6102, F6110, F6117, F6135, F6138, F6176, F6180, F6185, F6191, F6192, F6194, F6201, F6210, F6211, F6221, F6223, F6240, F6249, F6250, F6254, F6257, F6258, F6295, F9579, H6847, H6997, H7003, H7007, H7012, H7092, H7098, H7272, H7281.

Service use

Western Front: Clerget Camel—R.F.C. Squadrons Nos. 28, 43, 45, 54, 65, 70, 71 (Australian; later No. 4 Sqn., Australian Flying Corps) and 73. R.N.A.S. Sqns. Nos. 6, 8, 9 and 12. United States Air Service 41st, 148th and 185th Aero Sqns. Aviation Militaire Belge, lere, 4me, 6me and 11me escadrilles

Western Front, Le Rhône Camel—R.F.C. Sqns. Nos. 3, 46, 54, 71 (Australian), 73 and 80; night-fighting duties, Nos. 151 and 152. U.S. Air Service, 17th Aero Sqn.

B.R.1 Camel—R.N.A.S. Sqns. Nos. 1, 3, 4, 8, 9 and 10 (later Nos. 201, 203, 204, 208, 209 and 210, R.A.F.).

R.A.F. Fifth Group—No. 213 Sqn. (previously No. 13 Sqn., R.N.A.S.; originally R.N.A.S. Seaplane Defence Squadron, St. Pol); No. 471 Flight.

Italy—R.F.C. Sqns. Nos. 28, 45 and 66; Maj. W. G. Barker's Camel with No. 139 Sqn.

Adriatic Group—Sqns. Nos. 224, 225, 226 and 227.

Aegean Group—"C" Sqn., R.N.A.S., Gliki; "D" Sqn., R.N.A.S., Stavros; "F" Sqn., R.N.A.S., Thermi and Mudros; R.A.F. Sqns. Nos. 220, 222 and 223; Royal Hellenic Naval Air Service.

Macedonia—R.F.C./R.A.F. Sqns. Nos. 17, 47, 150 and 221.

Mesopotamia—No. 72 Sqn.

Russia—R.A.F. Sqns. Nos. 47 and 221; R.A.F. Contingent, Archangel; Slavo-British Aviation Group.

Home Defence—Sqns. Nos. 37, 44, 50, 61, 78, 112, 143, 212, 273;

R.N.A.S. Stations Dover, Isle of Grain, Manston, Felixstowe and Great Yarmouth.

Grand Fleet and Northern Patrol—A few F.1 Camels were flown as shipboard fighters; some were used during experiments with towed lighters.

U.S. Navy—F.1 Camels allocated to U.S.S. *Texas* and *Arkansas*.

Examples of F1. Camels used by operational squadrons

No. 3 Sqn., R.F.C.—*B6442* (Aircraft "A"), *C8374* ("G"), *D6477* ("Y"), *E1402*, *F2153* ("7"), *H801*. *No. 28 Sqn.*, R.F.C.—*B2461*, *B6344* ("G"), *D1911*, *D8239* ("R"), *E1581*, *F1921* ("C"). *No. 43 Sqn.*, R.F.C.—*B2431*, *B2510* ("A"), *C8247*, *C8281*, *D1848*, *E1467*. *No. 44 Sqn.*, R.F.C.—*B5402* ("2"), *B9175*. *No. 45 Sqn.*, France—*B2323*, *B4609*, *B6235*, *B6236*, *B6285*, *B6372*. *No. 45 Sqn.*, Italy—*B2340*, *B2430*, *B3872*, *B6238*, *B6412* ("D"), *B7381* ("H"). *No. 46 Sqn.*, R.F.C.—*B4618*, *B9149*, *C1559*, *C6722*, *D6585*, *H802*. *No. 47 Sqn.*, R.A.F., Russia—*F6396* (flown by Collishaw). *No. 54 Sqn.*, R.F.C.—*B5243*, *B9315*, *C8336*, *D1946*, *D6569*, *F5968*. *No. 65 Sqn.*, R.F.C.—*B6289*, *C8264*, *D1903*, *E7217*, *F6355*, *H7007*. *No. 66 Sqn.*, R.F.C.—*B2514*, *B5190*, *D1913*, *D8101*, *D9390*, *E7209*. *No. 70 Sqn.*, R.F.C.—*B2449*, *B5598*, *C1670*, *D6564*, *D8214*, *E7176*. *No. 71 Sqn.*, (No. 4 Sqn., A.F.C.)—*B2520*, *B7180*, *C8261*, *D8231*, *D9468*, *E7187*. *No. 73 Sqn.*, R.F.C.—*B5590*, *C3312*, *D1841*, *D6476*, *E1553*, *F6063*. *No. 80 Sqn.*, R.F.C.—*B9132*, *B9170*, *B9325*, *C1647*, *D9429*, *F6110*. *No. 112 Sqn.*, R.F.C.—*D6403*, *D6405*, *D6415*, *D6473*, *D6664*. *No. 139 Sqn.*, R.A.F.—*B6313* (Maj. Barker's Camel; also with Nos. 28 and 66 Sqns.). *No. 151 Sqn.*, R.A.F.—*B5412*, *C6725*, *D6660*, *E5142*, *F6084*, *H826*. *No. 1 Sqn.*, R.N.A.S. (No. 201, R.A.F.)—*B3884*, *B7248*, *C191*, *D3393*, *E4411*, *F5918*. *No. 3 Sqn.*, R.N.A.S. (No. 203, R.A.F.)—*B2442*, *B3936*, *B7187*, *C3363*, *D9594*, *N6364*. *No. 4 Sqn.*, R.N.A.S. (No. 204, R.A.F.)—*B7234*, *C76*, *D8188*, *E4418*, *F3929*, *N6361*. *No. 6 Sqn.*, R.N.A.S. (No. 206, R.A.F.)—*B3821*, *B6311*, *D1873*, *E7165*, *F5188*, *N6355*. *No. 8 Sqn.*, R.N.A.S. (No. 208, R.A.F.)—*B3819*, *B6349*, *B7192*, *D1867*, *D3352*, *N6342*. *No. 9 Sqn.*, R.N.A.S. (No. 209 R.A.F.)—*B3896*, *C58*, *D3327*, *E4389*, *H6997*, *N6370*. *No. 10 Sqn.*, R.N.A.S. (No. 201, R.A.F.)—*B6276*, *C144*, *D9616*, *E4407*, *F5914*, *N6347*. *No. 12 Sqn.*, R.N.A.S.—*B3759*, *B3905*, *B6259*, *B6297*, *N6357*, *N6372*. *Seaplane Defence Sqn. and No. 13 Sqn.*, R.N.A.S. (No. 213, R.A.F.)—*B3774*, *B6407*, *D3409*, *F3239*, *N6348*, *N6363*. *No. 227 Sqn.*, R.A.F.—*C43*, *C53*, *C133*. *C Sqn.*, R.N.A.S., Gliki—*B6254*. *D Sqn.*, R.N.A.S., Stavros—*B3769*, *N6367*. *F Sqn.*, R.N.A.S., Thermi and Mudros—*B6254*, *B6255*, *N6353*. *17th Aero Sqn.*, U.S.A.S.—*B7407*, *C8337*, *D3396*, *F2146*, *F6034*, *H7272*. *148th Aero Sqn.*, U.S.A.S.—*B7869*, *C3302*, *D6574*, *D8171*, *E1471*, *F5191*.

SPECIFICATION

Power

110-h.p. Clerget 9Z (first prototype only); 130-h.p. Clerget 9B; 140-h.p. Clerget 9Bf; 110-h.p. Le Rhône 9 J; 100-h.p. Gnôme Monosoupape; 150-h.p. B.R.1; 150-h.p. Gnôme Monosoupape; 170-h.p. Le Rhône 9R.

Dimensions

Span 28 ft.; length (Clerget) 18 ft. 9 in., (110-h.p. Le Rhône) 18 ft. 8 in., (B.R.1 and 150-h.p. Monosoupape) 18 ft. 6 in., (100-h.p. Monosoupape and 170-h.p. Le Rhône) 19 ft.; height 8 ft. 6 in.; chord 4 ft. 6 in.; gap at fuselage 5 ft.; stagger at fuselage 18 in., at struts $18\frac{3}{16}$ in.; dihedral, upper nil, lower 5 deg.; incidence 2 deg.; span of tail 8 ft.; wheel track 4 ft. 6 in.; tyres, Palmer 700 × 75 mm.; airscrew diameter 8 ft. 6 in.

Areas

Wings 231 sq. ft.; ailerons, each 9 sq. ft., total 36 sq. ft.; tailplane 14 sq. ft.; elevators 10·5 sq. ft.; fin 3 sq. ft.; rudder 4·9 sq. ft.

Armament

Two fixed 0·303-in. Vickers machine guns with Constantinesco C.C. synchronising mechanism for 110-h.p. Le Rhône engine, Kauper No. 3 interrupter gear for 130-h.p. Clerget; Hyland Type A loading handles and Feroto jam clearers; Aldis and ring-and-bead sights. Four 20-lb. Cooper bombs in racks under the fuselage. The night-fighter Camel usually had two 0·303-in. Lewis guns on a double Foster mounting with Hutton or Neame illuminated sights, but various combinations of Vickers and Lewis guns were tried.

WEIGHTS AND PERFORMANCE

Aircraft	F.1/1	F.1/3	B2312	F.1/3	F.1/3	B3829	N518
Engine	130-h.p. Clerget	130-h.p. Clerget No. 2730	130-h.p. Clerget No. 1498/ W.D.11647	140-h.p. Clerget 9Bf (1)	110-h.p. Le Rhône No. 100508/ W.D.7917	110-h.p. Le Rhône No. 35554/ W.D.9303	150-h.p. B.R.1 No. 1
Weights (lb)							
Empty	950	929	962	—	889	—	977
Military load	100	101	101	101	101	101	101
Crew	180	180	180	180	180	180	180
Fuel and oil	252	243	239	—	238	—	250
Loaded	1,482	1,453	1,482	1,452	1,408	1,422	1,508
Max. speed (m.p.h.)							
At 6,500 ft.	—	—	108	—	—	—	116·5
At 10,000 ft.	112·5	113	104·5	—	108·5	—	111
At 15,000 ft.	106	106·5	97·5	113·5	103	111·5	103
Climb to	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.
6,500 ft.	6 00	6 00	6 40	5 00	5 15	5 10	5 30
10,000 ft.	10 35	10 35	11 45	8 30	9 00	9 10	9 50
15,000 ft.	21 5	20 40	23 15	15 45	17 20	16 50	20 00
Service ceiling (ft.)	19,000	19,000	18,500	24,000	21,000	24,000	18,000
Endurance (hours)	2¾	2½	—	—	2¾	—	2½

Aircraft	B3835	B3835	B3835	B3811	U.S.A.S. camel	F6394	Two-seater
Engine	150-h.p. B.R.1 (2)	150-h.p. B.R.1 (3)	150-h.p. B.R.1 (4)	100-h.p. Monosoupape No. 30748/ W.D.1182	150-h.p. Monosoupape	170-h.p. Le Rhône	110-h.p. Le Rhône
Weights (lb.)							
Empty	—	—	—	882	993	1,048	889
Military load	101	101	101	101	101	101	Nil
Crew	180	180	180	180	180	180	360
Fuel and oil	—	—	—	224	249	238	159
Loaded	1,470	1,470	1,470	1,387	1,523	1,567	1,408
Max. speed (m.p.h.)							
At 6,550 ft.	—	—	—	—	—	—	—
At 10,000 ft.	—	111·5	121	110·5	117·5	113	103
At 15,000 ft.	110	107·5	114·5	102·5	107	108·5	—
Climb to	m. s.	m. s.	m s.	m s.	m. s.	m. s.	m. s.
6,500 ft.	5 30	5 00	4 35	6 50	5 50	5 30	10 35
10,000 ft.	9 25	8 50	8 20	11 50	10 20	9 35	18 55
15,000 ft.	18 00	17 10	15 55	23 15	19 40	17 30	41 30
Service ceiling (ft.)	20,000	19,500	22,000	18,500	21,500	21,500	—
Endurance (hours)	—	—	2½	2¾	2¼	—	—

(1) Compression ratio 5·29 to 1. (2) Standard induction pipes with 2-mm. holes, compression ratio 5·2 to 1. (3) Large induction pipes without holes, compression ratio 5·2 to 1. (4) Large induction pipes with 2-mm. holes, compression ratio 5·7 to 1.

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